Nuclear Energy, Science and Technology

(discretionary dollars in thousands)

	FY 2004 Comparable Approp	FY 2005 Comparable Approp	FY 2006 Request to Congress	FY 2006 vs. FY 2005	
Office Of Nuclear Energy, Science And Technology					
Energy Supply					
University reactor infrastructure and education assistance	23,055	23,810	24,000	+190	+0.8%
Research and development					
Nuclear energy plant optimization	2,863	2,480	——	-2,480	-100.0%
Nuclear energy research initiative	6,410	2,481	——	-2,481	-100.0%
Nuclear power 2010	19,360	49,605	56,000	+6,395	+12.9%
Generation IV nuclear energy systems initiative	26,981	39,683	45,000	+5,317	+13.4%
Nuclear hydrogen initiative	6,201	8,929	20,000	+11,071	+124.0%
Advanced fuel cycle initiative	65,750	67,462	70,000	+2,538	+3.8%
Total, Research and development	127,565	170,640	191,000	+20,360	+11.9%
Infrastructure	195,619	248,986	144,900	-104,086	-41.8%
Program direction	60,256	60,374	30,006	-30,368	-50.3%
Subtotal, Energy Supply	406,495	503,810	389,906	-113,904	-22.6%
Use of prior year balances and other adjustments	-115,309	-128,564	——	+128,564	+100.0%
Total, Energy Supply	291,186	375,246	389,906	14,660	+3.9%
Other Defense Activities					
Infrastructure	77,639	78,381	92,770	+14,389	+18.4%
Spent nuclear fuel management	——	1,488	——	-1,488	-100.0%
Program direction	33,979	33,519	31,103	-2,416	-7.2%
Subtotal, Other Defense Activities	111,618	113,388	123,873	+10,485	+9.2%
Use of prior year balances and other adjustments	——	-3,003	-3,003	——	——
Total, Other Defense Activities	111,618	110,385	120,870	+10,485	+9.5%
Total, Nuclear Energy, Science And Technology	**402,804**	**485,631**	**510,776**	**+25,145**	**+5.2%**

The **Office of Nuclear Energy, Science and Technology** (NE) is funded in two accounts within the Energy and Water Development Appropriations, Energy Supply and Other Defense Activities. All funding for research and development and other non-defense activities is requested within the Energy Supply account. Funding for defense related landlord activities for the Idaho National Laboratory, including Safeguards and Security, is requested within Other Defense Activities. The table above shows a summary of funding for the entire organization.

PROGRAM DESCRIPTION

NE leads the government's efforts to: develop new nuclear energy generation technologies to meet energy and climate goals; develop advanced, proliferation-resistant nuclear fuel technologies that maximize energy from nuclear fuel; and maintain and enhance the national nuclear infrastructure. NE serves the present and future energy needs of the country by managing the safe operation and maintenance of our critical nuclear infrastructure that provides nuclear technology goods and services. A key mission of DOE's nuclear energy research and development program is to lead the U.S. and international research community in planning and conducting basic and applied research to chart the way toward the next leap in technology. The aim of these efforts and those of industry and our overseas partners, is to

enable nuclear energy to fulfill its promise as a safe, advanced, inexpensive and environmentally benign approach to providing reliable energy to all of the world's people.

The programs within NE fully support development of new nuclear generation technologies that provide significant improvements in sustainability, economics, safety and reliability, and proliferation and resistance to attack. Specifically, the **Nuclear Hydrogen Initiative** will develop advanced technologies that can be used in tandem with next-generation nuclear energy plants to generate economic, commercial quantities of hydrogen to support a sustainable, clean energy future for the United States. The **Generation IV Nuclear Energy Systems Initiative** establishes a basis for expansive cooperation with our international partners to develop next-generation reactor and fuel cycle systems that represent a significant leap in economic performance, safety, and proliferation-resistance. Through the **Advanced Fuel Cycle Initiative**, DOE seeks to develop advanced, proliferation resistant nuclear fuel technologies that maximize the energy produced from nuclear fuel while minimizing wastes. In addition, the **Nuclear Power 2010** program supports intermediate-term research, technology development and demonstration activities that advance the "National Energy Policy" goals for enhancing long-term U.S. energy independence and reliability and expanding the contribution of nuclear power to the nation's energy portfolio.

PROGRAM HIGHLIGHTS

The FY 2006 request supports innovative applications of nuclear technology to develop new nuclear generation technologies and advanced energy products, develop advanced proliferation-resistant nuclear fuel technologies that maximize energy output, and maintain and enhance national nuclear capabilities to meet future challenges.

The **University Reactor Infrastructure and Education Assistance** program supports the operation and upgrade of university research and training reactors; provides fellowships and scholarships to outstanding students, brings nuclear technology education to small, minority-serving institutions, and provides nuclear engineering research grants. The program helps to maintain domestic capabilities to conduct research and the critical infrastructure necessary to attract, educate, and train the next generation of scientists and engineers with expertise in nuclear energy technologies. The Nuclear Engineering Education Research program stimulates innovative research at U.S. universities. The Innovations in Nuclear Infrastructure and Education initiative continues to support six university consortiums to spur innovative collaborations that integrate academics with the operation of university research reactors. DOE also provides fresh fuel to university research reactors and supports reactor equipment upgrades at universities. In FY 2006, the program will continue the Nuclear Engineering Support and Education program that supports outreach activities to pre-college teachers and students.

In FY 2004, DOE began to integrate the Nuclear Energy Research Initiative (NERI) activity directly into its mainline nuclear R&D programs. Solicitations were issued in late FY 2004 and the selection of 35 cooperative agreements will be awarded in early 2005 to U.S. universities to conduct research on the Generation IV, the Advanced Fuel Cycle Initiative, and the Nuclear Hydrogen Initiative programs. In FY 2006, no funding is requested in the NERI program as the mainline R&D programs will provide funding for the NERI university awards.

Under the **Nuclear Power 2010** program, DOE requests funding of $56.0 million in FY 2006 to complete the Early Site Permit demonstration projects with issuance of three Early Site Permits by the U.S. Nuclear Regulatory Commission (NRC). In addition, the program will complete the industry cost-shared project initiated in FY 2003 to develop generic guidance for the Construction and Operating License (COL) application preparation and to resolve generic

COL regulatory issues and continue the implementation phase of the two New Nuclear Plant Licensing Demonstration Projects awarded in FY 2005.

The goal of the **Generation IV Nuclear Energy Systems Initiative** (Gen IV) is to address the fundamental research and development issues necessary to establish the viability of next-generation nuclear energy system concepts. The 2006 budget provides $45 million for the Gen IV program to expand research and development that could help achieve the desired goals of sustainability, economics, and proliferation resistance.

The **Nuclear Hydrogen Initiative** (NHI) will conduct research and development on enabling technologies, demonstrate nuclear-based hydrogen production technologies and develop technologies that will apply heat from Generation IV nuclear energy systems to produce hydrogen. DOE's Offices of Nuclear Energy, Fossil Energy, Science, and Energy Efficiency and Renewable Energy are working together to provide the technological underpinnings of the **Hydrogen Fuel Initiative**. Research and development work carried out by NHI may enable the United States to generate hydrogen at a scale and cost that would support a future hydrogen-based economy. Current fossil-fuel-based methods emit greenhouse gases and are roughly four times more costly than the market will support.

The **Advanced Fuel Cycle Initiative**, which is integral to the Generation IV Nuclear Energy Systems effort, aims to develop a better, more efficient and proliferation-resistant nuclear fuel cycle. This research and development program is focusing on methods to reduce the volume and long-term toxicity of high-level waste from spent nuclear fuel, reduce the long-term proliferation threat posed by civilian inventories of plutonium in spent fuel, and provide for proliferation-resistant technologies to recover the energy content in spent nuclear fuel.

The **Radiological Facilities Management** program maintains irreplaceable DOE nuclear technology facilities in a safe, secure, environmentally compliant and cost-effective manner to support national priorities.

In FY 2005, INEEL was merged with Argonne National Laboratory-West (ANL-W) to create the Idaho National Laboratory (INL). The Secretary of Energy has designated INL as the center for DOE's strategic nuclear energy research and development efforts. The INL is a multi-program national laboratory that will play a lead role in the Generation IV Nuclear Energy Systems Initiative, the Advanced Fuel Cycle Initiative, and play an increasingly important role in supporting national security.

The **Idaho Facilities Management** program provides INL with the site-wide infrastructure required to support the laboratory's research and development programs. The Department has developed a detailed INL Ten Year Site Plan that will guide its investments in INL's infrastructure over the next decade and the government's objective to develop INL into a world-class nuclear energy research and development center by 2015.

The **Idaho Site-Wide Safeguards and Security** program protects DOE interests from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts, which could cause unacceptable adverse impacts on national security, program continuity, the health and safety of employees, the public, or the environment at the INL.

The **Program Direction** account provides the federal staffing resources and associated costs required to provide overall direction and execution of the Department's Nuclear Energy program. In FY 2006, NE will assume full responsibility for 2 FTE transferred from NNSA to support International Nuclear Safety activities. The FY 2006 budget request provides funding for the National Academy of Sciences to undertake a comprehensive, independent evaluation of the nuclear energy program's goals, plans, and the process for establishing program

priorities and oversight (including the method for determining the relative distribution of budgetary resources).

SIGNIFICANT FUNDING CHANGES – FY 2005 to 2006 Request ($ in millions)

University Reactor Infrastructure and Education Assistance
(FY 2005 $23.8; FY 2006 $24.0)..... +$0.2
Increase reflects additional fellowships/scholarships/grants (+$0.6), new activities that support pre-college education and outreach (+$0.2) and establish a Junior Faculty Research Grant initiative (+$0.3) offset by a decrease due to a reduction of the reactor fuel program fresh fuel requirements and spent fuel shipments (-$0.9).

Nuclear Energy Plant Optimization (FY 2005 $2.5; FY 2006 $0)..... -$2.5
Funds previously provided for NEPO will be allocated to other nuclear energy R&D efforts; funding is not requested for FY 2006.

Nuclear Energy Research Initiative (NERI) (FY 2005 $2.5; FY 2006 $0)..... -$2.5
Decrease reflects the restructuring to integrate NERI into the Department's mainline nuclear energy R&D programs.

Nuclear Power 2010 (FY 2005 $49.6; FY 2006 $56.0)..... +$6.4
Increase reflects continuation of the implementation phase of the two New Nuclear Plant Licensing Demonstration Projects that were awarded in FY 2005.

Generation IV Nuclear Energy Systems Initiative
(FY 2005 $39.7; FY 2006 $45.0)..... +$5.3
Increase reflects expansion of research and development efforts required to establish the technical viability of Generation IV technology.

Nuclear Hydrogen Initiative (FY 2005 $9.0; FY 2006 $20.0) .....+$11.0
FY 2006 request reflects an increase to support enhanced research and development on the sulfur-iodine thermochemical and high-temperature electrolysis hydrogen production methods, as well as on alternative hydrogen production methods operating across a range of temperatures to determine process viability. This includes initiation of sulfur-iodine cycle and HTE cell operational testing, fabrication of the laboratory-scale high-temperature heat exchanger, and continuation of the preliminary design of the pilot-scale.

Advanced Fuel Cycle Initiative (FY 2005 $67.5; FY 2006 $70.0)..... +$2.5
Increase reflects funding to complete laboratory-scale hot testing of advanced aqueous processes, research on alternative advanced separation technologies, develop a pre-conceptual design for an advanced fuel cycle research laboratory at INL (+$2.6), to complete LWR oxide transmutation fuel, inert matrix fuel and ultra-high burn-up fuel irradiations and post-irradiation examination (+$3.5) and to complete Advanced Test Reactor irradiation experiments on metal, nitride, dispersion and inert matrix fuels for transmutation and Generation IV fast reactor systems (+$3.6). Request also includes increases for broad systems studies, integrated fuel cycle system studies, and facility assessments, focusing principal activities on developing the information required to inform the 2007-2010 Secretarial recommendation regarding the need for a second repository (+$0.3), additional Ph.D. level AFCI fellowships (+$0.7) and increased funding for research and development activities associated with Small Business Innovative Research and Small Business Technology Transfer Programs (+$0.6). Increases are offset by a decease due to the completion of the design for the Materials Test Station (-$8.8).

Radiological Facilities Management (FY 2005 $68.6; FY 2006 $64.8) ..... -$3.8
FY 2006 request includes an overall decrease to the **Space and Defense Infrastructure** program (-$2.3). Decrease reflects completion of those activities associated with establishing the heat source and radioisotope power system assembly and testing operations at INL (-$1.9) and reducing the level of equipment for the assembly and testing activities to the level required for routine maintenance (-$0.6) offset by an increase to process more residues stored from prior year operations (+$0.2). In addition, the request includes a decrease in the **Medical Isotopes Infrastructure** program (-$1.5). Net decrease in the U-233 program reflects a shift of operating expenses to the line item project in accordance with DOE order 413 (-$1.7) and decreases in capital equipment purchases at LANL and BNL (-$0.4). Decreases are offset by increases for maintenance activities at ORNL, LANL, SNL and BNL (+$0.6).

Idaho Facilities Management (FY 2005 $112.2; FY 2006 $97.9) ..... -$14.3
FY 2006 request includes decreases for one-time costs in FY 2005 associated with restructuring the Idaho laboratory complex and supporting infrastructure services (-$43.5) and completion of the TRA Electrical Utility Upgrade in FY 2005 (-$1.5). Decrease is offset by an increase in maintenance at INL to work towards the goal of achieving and maintaining a Replace Plant Value rate of 2 to 4 percent, a level recommended by the National Academy of Sciences (+$9.2), network infrastructure improvement at INL (+4.4), general plant projects (+$6.1), Architect-Engineering services for preliminary and final engineering design and project management for the Remote Treatment Project and the Gas Test Loop in the Advanced Test Reactor (+$7.9), and initiation of construction activities including procurement of long lead items for the Gas Test Loop in the Advanced Test Reactor (+$3.1).

Idaho Site-Wide Safeguards and Security (FY 2005 $54.7; FY 2005 $72.0).....+$17.3
FY 2006 request includes ongoing implementation of the security enhancements required by the revised 2004 Design Basis Threat.

Program Direction (FY 2005 $60.0; FY 2006 $61.1)..... +$1.1
FY 2006 request includes funding to support new hires to manage expanding research and development programs, such as the Nuclear Hydrogen Initiative and Generation IV Nuclear Energy Systems Initiative, and to provide for cost-of-living adjustments (+$0.8). Request also includes an increase in other related expenses due to an increase to undertake a comprehensive, independent evaluation by the National Academy of Sciences of NE's research programs (+$1.0), an increase for utilities, training, and supplies, (+$0.1) offset by a reduction in telecommunications equipment, medical expenses and mailroom services at Idaho (-$0.9).